

# Introduction to Externalities: Early 1990s Methods and Results<sup>1</sup>

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## Abstract

In the early 1990s, studies on valuing externalities associated with electric power generation were motivated by desires to account for them in energy planning and decision making. The methods developed by research teams in the U.S. and Europe to estimate externality values were refinements of the impact pathway or damage function approach. This methodology follows a number of steps, each consisting of some modeling or analysis: (1) estimate the types and quantities of pollutant discharges and emissions, (2) predict their chemical transformation and dispersion in the atmosphere (or other media), (3) calculate the increased exposure to these pollutants, (4) estimate the associated health and environmental risks, and in some cases (5) express these risks in economic terms. The research teams utilized the state of scientific knowledge at each step. Thus, the estimates were based on scientific estimates of the value of the damages incurred, rather than on the costs of controlling the emissions or on regulatory standards.

The methodology has generally been applied to point sources at specific locations (though transportation-related methodologies have subsequently been developed as well). The early studies were the basis of some of the software that were subsequently developed to perform the calculations in one (or a very few) computer model(s).

The results of these studies emphasized that there was no single number for the externalities associated with, for example, sulfur dioxide emissions from coal-fired power plants. The numerical results among the studies varied significantly. In addition to the quantity of emissions, the estimates of the externalities depended largely on the geographic distribution of the population and of any sensitive ecosystems, relative to the location of the power plants, and on the epidemiological relationships used to calculate increases in mortality rates from pollutant exposure.

Some studies considered the life cycle aspects of the electricity sector and found that the externalities associated with fuel extraction and refining, transportation of fuel to the power plant, and power plant construction and decommissioning could be significant. Some studies also noted that market and regulatory conditions could internalize some of the effects. In these instances, although there might be adverse health or environmental impacts, their value would be reflected in energy prices and they would not be externalities.

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